of this book do contain some instances of carelessness, e.g. omitted or incorrect units, wrong sign of exponent in 10-factor, misconception that 'schematic' is a noun rather than an adjective, use of both 'molecular weight' and 'molecular mass' despite the editors' assertion in the Preface to adopt uniformly only the latter term. However, these must be regarded as only minor irritants within an authoritative whole, which gives a wealth of up-to-date practical detail and current applications. It should provide a useful addition to all polymer characterization laboratories.

M. B. Huglin
University of Salford

Handbook of Plastics Test Methods 3rd Ed

P. Brown (Ed.)
Longman Scientific and Technical in association with the Plastics and Rubber Institute, 1988, 442 pages, ISBN 0-582-03015-3

We are all too well aware of the problems associated with having to define the material characteristics which are important in the end use of a polymer and testing becomes second nature to us all. However, with the wide diversity of new materials being produced and environments into which they are placed, making the appropriate measurement under the correct conditions can be something of a nightmare. Accordingly there are international and national standard test methods so that we can all make the same mistakes together and hopefully we can keep up-to-date with them in as many tests as is appropriate.

The alternative approach is to buy the Handbook, and be assured that you are reading the "up-to-date account of today's test procedure" for quality assurance and material specification. It is indeed invaluable in any quality control and material testing laboratory

The value of this Handbook to the average polymer scientist is apparent when it is appreciated that this is the 3rd edition of a monograph first published in 1971 by Ives, Mead and Riley. Although the style and layout has not changed appreciably over the years a great many new tests and procedures are dealt with extensively.

The 3rd edition considers the preparation and conditioning of polymer samples, processibility and polymer characterization as well as measurement of mechanical properties such as stress–strain behaviour, dynamic response, friction and wear, creep and fatigue. Electrical behaviour and optical properties are also considered. Heat flow and specific heat measurements and the effect of thermal history and temperature on material properties are extensively discussed. Environmental testing and flame resistance of polymers are considered as well as diffusivity to gas and vapours. Finally there are sections on non-destructive testing and testing products. In all a fairly comprehensive list of test procedures is given. Each topic is generally covered thoroughly and a few important, invariably recent, references to further sources are given.

The Handbook is strongly recommended and material testing laboratories should not be without a copy.

J. N. Hay
University of Birmingham

Atlas of Polymer and Plastics Analysis

D. O. Hummel and F. Scholl
VCH Verlagsgesellschaft, Weinheim, FRG,
Vol. 1, 1978, xxxi+671 pages, DM490.00
ISBN 3-527-25801-9
Vol. 2, 1988, xxviii+577 pages, DM580.00
ISBN 3-527-26091-9

These two volumes, both of which have been written and organized by Professor Dieter Hummel, represent a major contribution to the scientific literature. The first volume consists of 1900 infra-red spectra from about 4000 to 400 cm^{-1} (on a linear wavelength scale), most of which have been obtained with the Beckman Spectrophotometer IR-12 under the author's supervision.

The decimal classification system for polymers has been used, but there are also additional alphabetic, formula and author indices, which were found to be very useful.

The second volume is really a *vade mecum* for the industrial analyst, and embraces the whole range of techniques now available. It provides a comprehensive practical guide, fulfilling three major objectives. Firstly, it introduces the reader to the principles of each technique in an extremely accessible manner. Secondly, it describes in detail the appropriate experimental procedures, drawing on the author's extensive professional experience. Finally it provides an authoritative compendium of data on a very wide range of polymers.

As might be anticipated, in view of Professor Hummel's personal interest and experience in infra-red spectroscopy, this does form the largest section of Volume 2. Its most unique feature is probably the very comprehensive compendium of infra-red band assignments. It is a highly personalized account in places, which this reviewer found very illuminating. There is rather less emphasis on Raman spectroscopy, whereas some practising spectroscopists would consider that infra-red and Raman spectroscopy ought to be considered complementary.

Other techniques covered in Volume 2 include high resolution n.m.r., e.s.r. and photo electron spectroscopy (PES/-XPS/ESCA). In addition there are introductory chapters on the identification of polymers and analysis of degradation and decomposition.

In conclusion, these volumes are outstanding value for those concerned with the chemical analysis of polymers, and they also contain useful reference information for those interested in the structure of polymers, although subjects such as molecular orientation are not discussed in very great detail. This series of volumes is certainly a necessary part of any comprehensive library in polymer science and technology and the author is to be congratulated for maintaining a very high standard of exposition throughout.

I. M. Ward
(University of Leeds)

Microelectronic Polymers

M. S. Htoo (Ed.)
Marcel Dekker, Inc., New York, 1989, vii+424 pages, $162.00
ISBN 0-8247-7990-8

The book gives an excellent up-to-date account of the use of polymers in lithographic processes for microelectronic device fabrication. It is written by 11 leading experts from the USA, Japan and Europe. The style is remarkably uniform throughout in spite of the number of contributors involved.

Chapter 1 reviews the chemistry of polymers and contains a discussion of their use as either positive or negative resists. Mention is also made of packaging materials. Chapter 2 considers film deposition, attention being focused on spin coating of polymeric resists from solution. Chapter 3 contains a very interesting exposition of optical-imaging theory that is needed to explain the exposure methods and resolution limits of optical lithography. The treatment is very clear, and provides a sound basis for understanding the characteristics of different types of polymers and the methodology which has led to increases in packing densities in microelectronic devices. I feel this section will be very useful to research students.

The next generation of very large-scale integrated circuit devices (with 16 Mbit dynamic random access memory) require

a minimum geometry around 0.5 μm. A new optical stepper which utilizes shorter wavelength light is under development for this purpose. For significantly higher resolutions, however, the newer imaging methods such as those using ion beams, electron beams or X-rays will be required. These non-optical lithographic methods are considered in detail in Chapter 4.

Once a pattern has been established on a mask there is a need to transfer it to the underlying substrate. Dry gaseous processing is capable of transferring images more accurately than wet etching, although the latter is less expensive. Chapter 5 deals briefly with the physics and chemistry of low-temperature reactive plasmas and then goes on to consider their application in dry-etching processes.

Gaining an understanding of the interactions between the exposure tool, the exposure environment, the resist materials, and the process conditions is an essential step in optimizing lithographic processes. A variety of modelling and simulation methods are comprehensively reviewed in Chapter 6. The results presented are very illuminating and show how relationships can be successfully established between the process parameters and performance in spite of the complexities involved. This contribution makes a very valuable addition to the book, tying together nicely work mentioned in earlier chapters.

Finally Chapters 7 and 8 review recent advances which have been made in Japan and Europe respectively. Of the 68 references to recent Japanese work (mainly covering work published from 1985–1987) 31 of them are written in Japanese.

For workers with a direct interest in lithographic polymers and processes the book should prove invaluable, and can be expected to be widely cited. Although of a specialized nature, the book can also be recommended for reading by polymer scientists in general, since it contains a well-balanced blend of introductory, mainstream and advanced material.

C. Price
(University of Manchester)

Erratum

'Glass transition behaviour of compatible polymer blends'

H. A. Schneider

Polymer 1989, **30**, 771–779

Equation (4) should read as follows:

$$\frac{T_{g2}-T_g}{\Phi_{f1}} = -\frac{\Psi_v^2(2A_{12}-A_{11}-A_{22})}{R(\ln\Psi_h+\Psi_v)}\Phi_{f1} - \frac{\Psi_v^2 2(A_{22}-A_{12})}{R(\ln\Psi_h+\Psi_v)} \quad (4)$$

Equation (11) should read as follows:

$$T_{g2}-T_g = -\frac{\Psi_v^2(2A_{12}-A_{11}-A_{22})}{R(\ln\Psi_h+\Psi_v)}\Phi_{f1}^2 - \frac{\Psi_v^2(-2A_{12}+A_{11}+A_{22})+\Psi_v^2(A_{22}-A_{11})}{R(\ln\Psi_h+\Psi_v)}\Phi_{f1} \quad (11)$$